

AMENDMENTS TO THE CLAIMS

1. (Canceled).

2. (Previously presented): A magnetic sensor which detects a magnetic field comprising:

a magnetoresistance effect element comprising a spin valve film, the film comprising a free layer, a spacer layer and a pinned layer whose magnetization direction is pinned, wherein said layers are successively laminated on a substrate of a single chip, the substrate having a rectangular shape which has two sides along an X-axis and two sides along a Y-axis, the X-axis and the Y-axis being perpendicular to each other in a plan view, said magnetoresistance effect element having a resistance value that changes in accordance with a relative angle formed by the magnetization direction of the pinned layer and a magnetization direction of the free layer;

said magnetic sensor being formed in such a manner that a plurality of said magnetoresistance effect elements are provided on a single plane, said magnetoresistance effect elements are placed symmetrically with respect to center lines of the rectangular shape, one of the center lines is a center line of the two sides along the X-axis and perpendicular to the Y-axis and the other of the center lines is a center line of the two sides along the Y-axis and perpendicular to the X-axis, and the pinned layers of at least two of said plurality of magnetoresistance effect elements have the pinned magnetization directions that cross each other.

3. (Previously presented): The magnetic sensor according to claim 2, wherein four of said plurality of magnetoresistance effect elements comprise;

a single axis magnetic sensor by full bridge connection of the four elements, the single axis magnetic sensor being an X-axis magnetic sensor for detecting a magnetic field along the X-axis or a Y-axis magnetic sensor for detecting a

magnetic field along the Y-axis, said pinned magnetization directions of the pinned layers of the four elements being parallel to each other.

4. (Currently Amended): A magnetic sensor which detects a magnetic field comprising:

eight magnetoresistance effect elements including a first through an eighth element, each of said elements comprising a spin valve film, the film comprising a free layer, a spacer layer and a pinned layer, said pinned layer having a pinned magnetization direction, wherein said layers are successively laminated on a substrate of a single chip, the substrate having a rectangular shape which has a left side along a Y-axis, a right side along the Y-axis, a top side along an X-axis and a bottom side along the X-axis in a plan view, the X-axis and the Y-axis are perpendicular to each other, and each of the elements has a resistance value that changes in accordance with a relative angle formed by a magnetization direction of said pinned layer and a magnetization direction of said free layer;

said magnetic sensor being formed in such a manner that said magnetoresistance effect elements are provided on a single plane,

(a) said first element being formed at a position closer to the left side than the right side and below a first center line of the left side and the right side, the first center line being perpendicular to the Y-axis, and said first element, having a pinned magnetization direction of said first element's pinned layer in a direction of the X-axis;

(b) said second element being formed at a position closer to the left side than the right side and above the first center line, and said second element having a pinned magnetization direction of said second element's pinned layer in the direction of the X-axis;

(c) said third element being formed at a position closer to the right side than the left side and above the first center line, and said third element having a pinned magnetization direction of said third element's pinned layer in the direction of the X-axis;

(d) said fourth element being formed at a position closer to the right side than the left side and below the first center line, and said fourth element having a pinned magnetization direction of said fourth element's pinned layer in the direction of the X-axis;

(e) said fifth element being formed at a position closer to the top side than the bottom side and left of a second center line of the top side and the bottom side, the second center line being perpendicular to the X-axis, and said fifth element having a pinned magnetization direction of said fifth element's pinned layer in the direction of the Y-axis;

(f) said sixth element being formed at a position closer to the top side than the bottom side and right of the second center line, and said sixth element having a pinned magnetization direction of said sixth element's pinned layer in the direction of the Y-axis;

(g) said seventh element being formed at a position ~~closed~~closer to the bottom side than the top side and right of the second center line, and said seventh element having a pinned magnetization direction of said seventh element's pinned layer in the direction of the Y-axis; and

(h) said eighth element being formed at a position closer to the bottom side than the top side and left of the second center line, and said eighth element having a pinned magnetization direction of said eighth element's pinned layer in the direction of the Y-axis.

5. (Previously presented): The magnetic sensor according to claim 4 wherein:

(a) said first to fourth elements construct an X-axis magnetic sensor for detecting a magnetic field in the direction of the X-axis by full bridge connection of the first to fourth elements; and

(b) said fifth to eighth elements construct a Y-axis magnetic sensor for detecting a magnetic field in the direction of the Y-axis by full bridge connection of the fifth to eighth elements.

6. (Previously presented): The magnetic sensor according to claim 5, wherein:

(a) the pinned magnetization direction of the pinned layer of the first and the second elements are in a negative direction of the X-axis;

(b) the pinned magnetization direction of the pinned layer of the third and the fourth elements are in a positive direction of the X-axis;

(c) the pinned magnetization direction of the pinned layer of the fifth and the sixth elements are in a positive direction of the Y-axis; and

(d) the pinned magnetization direction of the pinned layer of the seventh and the eighth elements are in a negative direction of the Y-axis.

7. (Currently Amended): A magnetic sensor which detects a magnetic field comprising a plurality of magnetoresistance effect elements, each element comprising a spin valve film, the film comprising a free layer, a spacer layer and a pinned layer having a pinned magnetization direction, the element having a resistance value that changes in accordance with a relative angle formed by a magnetization direction of the pinned layer and a magnetization direction of the free layer, wherein:

(a) said layers of each of the magnetoresistance effect elements are successively laminated directly on a single substrate of a single chip;

(b) an X-axis group of four of a plurality of said magnetoresistance effect elements constructs ~~an~~ a single X-axis magnetic sensor for detecting a magnetic field in an X-axis direction; and all of said magnetoresistance effect elements of the X-axis group have pinned magnetization directions of the pinned layers parallel to each other, and

(c) a Y-axis group of four of a plurality said magnetoresistance effect elements constructs a single Y-axis magnetic sensor for detecting a magnetic field in a Y-axis direction perpendicular to the ~~X-axis~~, X-axis direction and all of said magnetoresistance effect elements of the Y-axis group have pinned magnetization directions of the pinned layers parallel to each other.

8. (Previously presented): The magnetic sensor according to claim 7, wherein:

(a) said X-axis group of magnetoresistance effect elements construct the X-axis magnetic sensor by full bridge connection, and the pinned magnetization directions of the X-axis group of magnetoresistance effect elements are in the X-axis direction; and

(b) said Y-axis group of magnetoresistance effect elements construct the Y-axis magnetic sensor by full bridge connection, and the pinned magnetization directions of the Y-axis group of magnetoresistance effect elements are in the Y-axis direction.

9-16. (Canceled).

17. (New) The magnetic sensor of claim 7, wherein said X-axis group of four of a plurality of said magnetoresistance effect elements constructs said single X-axis magnetic sensor by a wiring formed directly on said single substrate; and

wherein said Y-axis group of four of a plurality of said magnetoresistance effect elements constructs said single Y-axis magnetic sensor by a wiring formed directly on said single substrate.

18. (New) The magnetic sensor according to claim 8 wherein said Y-axis sensor is disposed within an area defined by said X-axis sensor.